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# THE CENTER

U.S. Department of Agriculture  
Agricultural Research Service  
The Western Regional Research Center  
800 Buchanan Street  
Albany, CA 94710

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Volume III, Issue 1

February 1998

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## Reduction and Control of Aflatoxin in Tree Nuts

### Biological and Chemical Control

Aflatoxin is a naturally occurring substance which can contaminate many plants including corn, peanuts, cottonseed, tree nuts and figs. Contamination occurs only after infection by certain fungi that make the aflatoxin. The FDA has set a minimum level for aflatoxin and has stated that lower levels are unnecessary. However, some foreign countries have set aflatoxin levels five-fold lower than the U.S. level. Hence, the issue of aflatoxin contamination of food commodities is a potential trade issue.

Research efforts at WRRC are aimed at eliminating or lowering aflatoxin in almonds, walnuts and pistachios. Collectively, these tree nuts are valued at about \$1.5 billion per year. California is the only commercial producer of these nuts in the United States and over 60% are exported.

Scientists in the Plant Protection Research (PPR) unit at WRRC are using a number of research approaches aimed at reducing contamination of nuts while they are still on the tree. Wounding by insect-feeding is one of the main avenues through which aflatoxin-making fungi gain access to tree nuts. Research on thwarting insects currently includes studying the use of pheromones (insect sexual "perfumes") in combination with odors from plants as a means of disrupting insect-mating and tree nut locating behaviors. Working closely with plant breeders in the Department of Pomology at the University of California, Davis, WRRC scientists are also identifying natural chemical constituents in tree nuts that reduce insect feeding or fungal growth. Certain compounds that prevent aflatoxin formation have already been identified in various tissues of walnuts, pistachios and almonds.

Additionally, WRRC scientists have found yeasts that prevent fungi from making aflatoxin. These yeasts naturally occur in tree nut orchards and are not toxic to humans. They could potentially serve as biological control agents to naturally control fungal growth and aflatoxin production in tree nut orchards.

Aflatoxin contamination can also occur after harvesting. Pistachios that have not split naturally after drying comprise about 15% of the post-harvest crop. Some of these nuts are rehydrated, to facilitate cracking by hand. PPR scientists recently discovered that rehydration of closed-shell pistachios increases the risk of aflatoxin contamination, and should be avoided if possible. If the process is used, rehydrated nuts should be dried immediately and protected from high humidity.

Contact: Bruce Campbell  
(510) 559-5846  
E-mail: [bcc@pw.usda.gov](mailto:bcc@pw.usda.gov)

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## **Mechanical Sorting/Screening**

Another approach to reducing aflatoxin is sorting to remove individual nuts which are contaminated. Researchers in another WRRRC unit are working on sorting methods for pistachios which have had the highest average aflatoxin levels among tree nuts. Work at WRRRC has shown that the toxin is contained in a very few nuts (1 in 100,000 or so), but at very high levels in nuts which are infected. WRRRC researchers have been able to develop a sampling protocol which allows for the detection of these rare infested nuts. New sorting methods, also developed at WRRRC have helped the pistachio industry remove the objectionable nuts and thus further reduce the overall aflatoxin levels four-fold from what they were previously.

These sorting and testing methods are now being refined at WRRRC. To improve sorting, WRRRC researchers have developed a real-time machine vision system, which identifies staining patterns on pistachio nut shells that indicate pre-harvest hull split and potential aflatoxin contamination. The image sorter has been tested at a California pistachio processing plant with nuts that had been through a color sorter. The image sorter found 98% of the nuts which remained in the main processing stream to be

acceptable and rejected 2%. All of the aflatoxin contaminated nuts were separated into the reject group. Sorting rates and

cost of the of the imaging system are competitive with current commercial color sorters. The real-time vision system has been patented by USDA and is available for licensing.

Contact: Tom Schatzki  
(510) 559-5672  
E-mail: tom@pw.usda.gov

### **WRRC Patent Activity September 1997 - January 1998**

#### **U.S. Patents Issued:**

December 30, 1997,  
No. 5,703,784  
"Machine Vision Apparatus and  
Method for Sorting Objects"  
Inventor: Thomas C. Pearson

#### **U.S. Patent Applications Filed (Provisional):**

September 18, 1997  
"Modification of Starch  
Branching Patterns and Chain  
Length Distribution via  
Transformation with Starch  
Biosynthetic Enzymes"  
Inventors: Kent McCue  
Olin Anderson

December 9, 1997  
"Membrane Sensor for  
Monitoring Chlorine Dioxide in  
Food Processing Water"  
Inventors: Lee-Shin Tsai  
Bradeley Hernlem  
Charles Huxsoll

#### **Licenses Granted:**

"Stable, Germicidal Film-  
Forming Teat-Dip Solutions,"  
granted to West Agro, Inc.,  
Kansas City, Missouri,  
September 15, 1997.

### **How Do Businesses Get Access to These Technologies?**

WRRRC is seeking private companies interested in licensing technologies which have been patented or for which a patent application has been filed. For other projects we are looking for companies interested in becoming our partners in Cooperative Research and Development Agreements (CRADAs). CRADA partners have the first right to negotiate an exclusive license for each invention which is made as part of the CRADA. We encourage small and minority-owned business to take part in our technology transfer programs.

**The Center** is a quarterly newsletter compiled by WRRRC to alert potential partners of technology transfer opportunities.

**William J. Hurkman**  
Acting Director  
Phone: 510/559-5600  
Fax: 510/559-5963  
E-mail: bhurkman@pw.usda.gov

**Martha Bair Steinbock**  
Technology Transfer Coordinator  
Phone: 510/559-5641  
Fax: 510/559-5963  
E-mail: mbs@pw.usda.gov